provide an X-ray tire inspection method and apparatus capable of carrying out the internal inspection of even a tire having a low aspect ratio accurately and efficiently.

Summary of the Invention

The inventors of the present invention have conducted intensive studies and have found that when an X-ray is applied from right above the end portion 10a of a tire as shown in Fig. 10, the dead areas 11x and 12x formed by the belt wires 11 and tread belt 12 become the smallest in half of a transmission X-ray image of the tire 10. The present invention has been accomplished based on this finding.

That is, according to a first aspect of the present invention, there is provided method of inspecting the interior of a tire from a transmission X-ray image of the tire obtained by applying an X-ray to the conveyed tire from X-ray application means, comprising the step of applying the X-ray to at least two positions of the tires as a specimen to take transmission X-ray images of the tire. Thereby, an x-ray image having few shadows of the bead wires and the tread belt can be obtained, thereby making it possible to inspect the interior of the tire accurately.

According to a second aspect of the present invention, there is provided an X-ray tire inspection

the X-ray application means;

selecting two out of the transmission X-ray images of the tire to combine the transmission X-ray images of half portions near the X-ray application means of the tire so as to form a transmission X-ray composite image of the whole tire; and

inspecting the interior of the tire from the transmission X-ray composite image of the whole tire.

According to a sixth aspect of the present invention, there is provided an X-ray tire inspection apparatus comprising means of conveying tires, means of applying an X-ray to the conveyed tire and X-ray sensors for taking transmission X-ray images of the tire to inspect the interior of the tire from a transmission X-ray image obtained with the X-ray sensors, wherein

the X-ray application means are installed at positions corresponding to at least two positions of the conveyed tire. Thus, by taking transmission X-ray images of the tire from at least two directions by using at least two X-ray application means, an image of the interior of the tire having the smallest dead area can be obtained, thereby making it possible to improve the accuracy of the internal inspection of the tire.

According to a seventh aspect of the present invention, there is provided an X-ray tire inspection

What is claimed is:

1. A method of inspecting the interior of a tire from a transmission X-ray image of the tire obtained by applying an X-ray to the conveyed tire from X-ray application means, comprising the step of applying the X-ray to at least two positions of the tires as a specimen to take transmission X-ray images of the tire.

2. The X-ray tire inspection method according to claim 1, wherein the outer diameter of the conveyed tire is measured and the positions of the X-ray application means are changed according to the measurement result.

3. The X-ray tire inspection method according to claim 2, wherein the X-ray application means are installed a predetermined distance inward from the measurement positions of the outer diameter of the tire.

4. The X-ray tire inspection method according to any one of claims 1 to 3, wherein two out of the transmission X-ray images of the tire are selected, transmission X-ray images of half portions near the X-ray application means of the tire are combined to form a transmission X-ray composite image of the whole tire, and the interior of the tire is inspected from this transmission X-ray composite image of the whole tire.

7. The X-ray tire inspection apparatus according to claim 6, which further comprises image combining means for selecting two out of the transmission X-ray images of the tire to combine transmission X-ray images of half portions near the X-ray application means of the tire and judging means for judging whether the tire is acceptable or not from a transmission X-ray composite image of the whole tire formed by the image combining means.

8. The X-ray tire inspection apparatus according to claim 6 or 7, which further comprises means of measuring the outer diameter of the conveyed tire and means of moving the X-ray application means to positions a predetermined distance inward from the measurement positions of the outer diameter of the tire.

9. The X-ray tier inspection apparatus according to any one of claims 6 to 8, wherein the X-ray application means are installed at opposite positions right above the inner wall portion of the tread belt.

10. The X-ray tire inspection apparatus according to any one of claims 6 to 9, wherein one of the X-ray application means and an X-ray sensor for taking a transmission X-ray image of the tire with the X-ray